COPC: **Nickel** CAS 7440-02-0

Test Organisms: Chicken (Omnivore, Order-Galliformes)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Weber, C.W., and Reid, B.L., 1968, *Nickel toxicity in growing chicks*, J. Nutr. 95:612-616.
QCE: 37 mg/kg-day — 500 ppm in diet converted to a dose using an estimated ingestion rate* of 0.037 kg/day and a body weight of 500 g from the study.

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Subchronic toxicity studies with adequate numbers of animals
Q_1	1	1	1	Production parameters (growth)
Q_2	2	2	2	Subchronic study
Q_3	1	1	1	NOAEL endpoint
U	3	3	3	Older study, reproductive endpoints not evaluated
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	37	37	37	QCE = quantified critical endpoint
TRV	6.2	3.1	2.1	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	6.2	Test organism is in the same order and trophic level as the functional group members	none
2	3.1	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	2.1	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

*Estimated as 0.0582 $Wt^{0.651}$ (kg) as cited in EPA, 1993. Wildlife Exposure Factors Handbook.

COPC: **Nickel** CAS 7440-02-0
(nickel carbonate)

Test Organisms: Bovine (Herbivore, Order-Artiodactyla)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: O'Dell et al., 1970a, "Effect of Nickel Supplementation on the Production and composition of Milk, *J. Dairy Science.* National Academy of Sciences, 1980, *Mineral Tolerance of Domestic Animals,* Washington, DC.
QCE: 4.1 mg/kg-day 1835mg/day/450 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Secondary source
Q_1	1	1	1	Growth and food intake
Q_2	2	2	2	Subchronic study
Q_3	1	1	1	NOAEL endpoint
U	3	3	3	Limited information or supporting studies.
Total AF	18	36	54	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	4.1	4.1	4.1	QCE = quantified critical endpoint
TRV	0.23	0.11	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.23	Test organism is in the same order and trophic level as the functional group members	none
2	0.11	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	0.08	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A

*BW an estimate until get actual article

**Other O'Dell articles may be more helpful, check the NAS book.

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Mallard Duck
Exposure Medium: Oral in diet
Test Endpoint: NOAEL
Reference: Cain, B.W. and E.A. Pafford, 1981, "Effects of Dietary Nickel on Survival and Growth of Mallard Duckling", *Arch. Environm. Contam. Toxicol.* 10, 737-745.
QCE: 200 ppm

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	36 ducklings divided into 6 cages with 6 birds per cage (3 male 3 female). 12 birds were given a dose of either 200, 800, or 1200 ppm.
Q_1	1	1	1	Development endpoints measured (body weight, bill length, humerus, heart, liver, gizzard, kidneys).
Q_2	1	1	1	Chronic study (60-90 days)
Q_3	1	1	1	NOAEL
U	1	1	1	Good supporting references.
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	200	200	200	QCE = quantified critical endpoint
TRV	100	50	33	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	100	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	50	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	33	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Dog (Omnivore, Order-Carnivora)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Ambrose, A.M. et al. 1976, *Long-Term Toxicologic Assessment of Nickel in Rats and Dogs,* J. Food Sci. Technol. 13:181-187.
QCE: 25 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Chronic toxicity study with adequate numbers of animals
Q_1	1	1	1	Body weight gain
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Limited information or supporting studies.
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	25	25	25	QCE = quantified critical endpoint
TRV	13	6.3	4.2	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	13	Test organism is in the same order and trophic level as the functional group members	M422A
2	6.3	Test organism is in a different order and same trophic level from the functional group members	M422
3	4.2	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M322

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Mallard (Herbivore, Order-Anseriformes)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Eastin, W.C., Jr. and O'Shea, T.J., 1981, *Effects of Dietary Nickel on Mallards*, J. Toxicol. Environ. Health 7(6):883-892.
White, D.H., and M.P. Dieter, 1978, *Effects of Dietary Vanadium in Mallard Ducks*, Journal of Toxicol. and Environ. Health, 4:43-50.
QCE: 140 mg/kg-day (800mg/kg food)*(0.205mg/day*)/1.17 kg BW **

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Subchronic toxicity study; variability not addressed
Q_1	1	1	1	Egg production, hatchability, duckling survival; hematological parameters
Q_2	2	2	2	Subchronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Reproductive endpoints evaluated, no LOAEL identified.
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	140	140	140	QCE = quantified critical endpoint
TRV	17.5	8.75	5.83	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	17.5	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	8.75	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	5.83	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

*Birds on 800ppm diet ate 15% more food than the 178g/day of the controls = 205g
**Body weight is indicated in the 1978 White and Dieter study.

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Ambrose, A.M., et al., 1976 *Long-Term Toxicologic Assessment of Nickel in Rats and Dogs,* J. Food Sci. Technol. 13:181-187.
ABC (American Biogenics Corp.), 1986, *Ninety-Day Gavage Study in Albino Rats Using Nickel,* Draft Final Report submitted to Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709.
RTI (Research Triangle Institute), 1987, *Two Generation Reproduction and Fertility Study of Nickel Chloride Administered to CD Rats in Drinking Water: Fertility and Reproductive Performance of the Po Generation (Part II of III) and F1 Generation (Part III of III),* Final study report, Report submitted to Office of Solid Waste Management, U.S. EPA, Washington, DC.
QCE: 5 mg/kg-day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Chronic toxicity study with adequate numbers of animals.
Q_1	1	1	1	Body weight gain
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Low survival in controls; however, another study by ABC, 1986 supports the 5 mg/kg/day NOAEL. A NOAEL for reproductive effects in a study by RTI (1987) was higher than the Ambrose study.
Total AF	2	4	6	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	5	5	5	QCE = quantified critical endpoint
TRV	2.5	1.3	0.83	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	2.5	Test organism is in the same order and trophic level as the functional group members	none
2	1.3	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.83	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Nitrate** CAS 1594-56-5

Test Organisms: Rabbits (Herbivores, Order-Lagomorpha)
Exposure Medium: Oral in diet
Test Endpoint: Adverse effect level - reproductive (reduced fertility)
Reference: Southwest Vet., 24:246, 1974; HSDB.
QCE: 3994 mg/kg-day (from potassium nitrate)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Secondary source so information on number and sexes of animals tested unknown. Pregnant females tested.
Q_1	1	1	1	Ecologically relevant endpoint (reproduction)
Q_2	2	2	2	Subchronic exposure (days 23 through 27 of pregnancy)
Q_3	3	3	3	Adverse effect level
U	2	2	2	Limited information, no reproductive endpoints and sensitive life stage examined. No NOAEL established.
Total AF	24	48	72	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	3994	3994	3994	QCE = quantified critical endpoint
TRV	166.4	83.21	55.47	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	166.4	Test organism is in the same order and trophic level as the functional group members	none
2	83.21	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	55.47	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A

COPC: Nitrate CAS 1594-56-5

Test Organisms: Juvenile turkeys (Omnivore, Order-Galliformes)
Exposure Medium: Oral in drinking water
Test Endpoint: FEL
Reference: Humphreys Vet. Toxicol., 3rd Ed., 1988: HSDB.
QCE: 481 mg/kg-day (from sodium nitrate)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Secondary source so information on number and sexes of animals tested unknown.
Q_1	1	1	1	Ecologically relevant endpoint (lethality)
Q_2	3	3	3	Duration of exposure unknown
Q_3	3	3	3	FEL
U	2	2	2	Limited information and reproductive endpoints and sensitive life stages examined. No NOAEL established.
M	0.5	0.5	0.5	Placed in drinking water.
Total AF	18	36	54	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	481	481	481	QCE = quantified critical endpoint
TRV	26.7	13.4	8.9	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	26.7	Test organism is in the same order and trophic level as the functional group members	none
2	13.4	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	8.9	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

COPC: **PCBs (Aroclor 1254)** CAS 11097-69-1

Test Organisms: Pheasant (*Phasianus colchicus*, Omnivore, Order-Galliformes)
Exposure Medium: Gelatin capsule with corn oil
Test Endpoint: LOAEL
Reference: Dahlgren, R.B., R.L. Linder, and C.W. Carlson, 1972, *Polychlorinated Biphenyls: Their Effects on Penned Pheasants*, Environmental Health Perspectives, 1:89-101.

QCE: 1.8 mg/kg-day 12.5 mg/wk for 16 weeks; assumed BW of 1 kg (Wildlife Exposure Factors Handbook (EPA, 1993))

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Results presented in this paper are from 1970 and 1971 study. The 1970 part was reported in Dahlgren and Linder (1971). Two groups of 5 cocks each were given weekly gelatin capsule with control or 25 mg PCB. Hens (30 in 1970 and 34 in 1971) were given weekly a gelatin capsule with either 12.5 or 50 mg PCB. Some differences seen from 1st to 2nd year.
Q_1	1	1	1	# eggs laid, egg fertility, hatchability, eggshell thickness, and chick behavior, weight and survival. Ecologically relevant endpoint
Q_2	1	1	1	Chronic duration (16 weeks)
Q_3	2	2	2	LOAEL endpoint
U	2	2	2	Very thorough study that looks at ecologically relevant endpoints (relatively insensitive neuro. endpoints). Bolus dosing method might result in less absorption than daily exposure and exposure subchronic to adults only; however, effects noted were slight and variable, and dose-response varied from one year to the next, however, lowest dose (at which response was seen) was used. No NOAEL established.
Total AF	8	16	24	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	1.8	1.8	1.8	QCE = quantified critical endpoint
TRV	0.23	0.11	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.23	Test organism is in the same order and trophic level as the functional group members	none
2	0.11	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	0.08	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

Dahlgren, R.B., and R.L. Linder, 1971, *Effects of Polychlorinated Biphenyls on Pheasant Reproduction, Behavior, and Survival*, Journal of Wildlife Management, 35(2):315-319

COPC: **PCBs (Aroclor 1254)** CAS 11097-69-1

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Diet in chow
Test Endpoint: NOAEL
Reference: Linder, R.E., T.B. Gaines, and R.D. Kimbrough, 1974, *The Effect of Polychlorinated Biphenyls on Rat Reproduction*, Food and Cosmetic Toxicology, 12:63-77.
QCE: 0.32 mg/kg-day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Well-designed long-term study
Q_1	1	1	1	Liver weights, # of litter, litter size, and survival of young. Ecologically relevant endpoints
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Thorough, well-designed and analyzed, relevant study. Multiple doses examined at different generations.
Total AF	1	2	3	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	0.32	0.32	0.32	QCE = quantified critical endpoint
TRV	0.32	0.16	0.11	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.32	Test organism is in the same order and trophic level as the functional group members	none
2	0.16	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.11	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **PCBs (Aroclor 1260)** CAS 11096-82-5

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Diet in chow
Test Endpoint: NOAEL
Reference: Linder, R.E., T.B. Gaines, and R.D. Kimbrough, 1974, *The Effect of Polychlorinated Biphenyls on Rat Reproduction*, Food and Cosmetic Toxicology, 12:63-77.
QCE: 7.4 mg/kg-day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Well-designed long-term study showed relatively low variability in response (10 males and 20 females)
Q_1	1	1	1	Ecologically relevant endpoint: viability counts of offspring, body weights, livers, weights of spleen, heart, lungs, brain, kidneys, testes.
Q_2	1	1	1	Chronic duration
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Thorough, well-designed and analyzed, relevant study, testing different doses (0,5,20,100ppm). Started on diets at 3-4 weeks of age, doses continued through mating, gestation, and lactation. No LOAEL established.
M	1	1	1	Not applicable
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	7.4	7.4	7.4	QCE = quantified critical endpoint
TRV	7.4	3.7	2.5	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	7.4	Test organism is in the same order and trophic level as the functional group members	none
2	3.7	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	2.5	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **PCBs (Aroclor 1254)** CAS 11097-69-1

Test Organisms: Mink (Carnivore, Order-Carnivora)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Aulerich, R.J. and R.K. Ringer. 1977. Current status of PCB toxicity, including reproduction in mink. Arch. Environ. Contam. Toxicol. 6:279.
QCE: 0.137 mg/kg-day 1 ppm in diet, 0.137 kg food/day (Bleavins and Aulerich 1981), and 1 kg BW (EPA, 1993)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	
Q_1	1	1	1	Reproductive performance (# of kits born). Ecologically relevant endpoint
Q_2	1	1	1	Chronic duration (4.5 months)
Q_3	1	1	1	NOAEL
U	1	1	1	Three dose levels (1, 5, and 15 ppm). Aroclor 1254 at 5 & 15 ppm in the diet reduced the number of offspring born alive.
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.137	0.137	0.137	QCE = quantified critical endpoint
TRV	0.137	0.068	0.046	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.137	Test organism is in the same order and trophic level as the functional group members	M322
2	0.068	Test organism is in a different order and same trophic level from the functional group members	none
3	0.046	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M422,M422A

COPC: **PCBs (Aroclor 1254)** CAS 11097-69-1

Test Organisms: Mink (Carnivore, Order-Carnivora)
Exposure Medium: Diet (Great Lakes fish)
Test Endpoint: NOAEL
Reference: Hornshaw, T.C., R.J. Aulerich, and H.E. Johnson, 1983, *Feeding Great Lakes Fish to Mink: Effects on Mink and Accumulation and Elimination of PCBs by Mink*, Journal of Toxicology and Environmental Health, 11:933-946.
QCE: 0.03 mg/kg-day 0.21 ppm in diet, 0.15 kg/kg BW food factor for mink (EPA, 1993)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Adequate numbers tested. During the first year, 96 subadult mink were randomly assigned to 1of six dietary groups (4 males and 12 females). First year: control, perch, sucker, carp, whitefish, and alewife. Second year 28 females assigned to either a std mink or perch & sucker diet. Results of this study comparable to many others as mentioned in text.
Q_1	1	1	1	Body weights of adults and offspring, reproductive performance (# of females whelped, kits whelped), liver weights. Ecologically relevant endpoint
Q_2	1	1	1	Chronic duration (39 weeks)
Q_3	1	1	1	NOAEL
U	2	2	2	Study provides a somewhat realistic means of exposure to mink, which are known to be considerably more sensitive to the toxicity of PCBs and related compounds than other mammalian carnivores, but study estimates based on different feeding diets.
Total AF	2	4	6	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	0.03	0.03	0.03	QCE = quantified critical endpoint
TRV	0.015	0.008	0.005	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	.015	Test organism is in the same order and trophic level as the functional group members	M322
2	.008	Test organism is in a different order and same trophic level from the functional group members	none
3	.005	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M422,M422A

COPC: **PCBs (Aroclor 1254)** CAS 11097-69-1

Test Organisms: Oldfield mouse (Omnivore, Order-Rodentia)
Exposure Medium: Oral in diet
Test Endpoint: FEL
Reference: McCoy, G., et al., 1995. Chronic polychlorinated biphenyls exposure on three generations of oldfield mice (*Permyscus polionotus*): effects on reproduction, growth, and body residues. *Arch. Environ. Contam. Toxicol.* 28:431-435.

QCE: 0.68 mg/kg-day Body weight: 0.014 kg (from Silva and Downing 1995), ingestion rate 0.135 g food/g BW/day.

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Well-designed long-term study showed relatively low variability in response
Q_1	1	1	1	# of litters, offspring weights and survival. Ecologically relevant endpoint
Q_2	1	1	1	Chronic duration (12 months, >1 yr. and during a critical life stage)
Q_3	3	3	3	FEL
U	3	3	3	Only one dose level.
Total AF	9	18	27	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	0.68	0.68	0.68	QCE = quantified critical endpoint
TRV	0.076	0.038	0.025	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.076	Test organism is in the same order and trophic level as the functional group members	none
2	0.038	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.025	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Linzey, A.V. 1987, "Effects of chronic polychlorinated biphenyls exposure on reproductive success of white-footed mice (*Peromyscus leucopus*)." *Arch. Environ. Contamin. Toxicol.* 16: 455-460.

COPC: **Pyrene** CAS 129-00-0

Test Organisms: Mouse (Omnivore, Order-Rodentia)
Exposure Medium: Oral in diet
Test Endpoint: NOAEL
Reference: EPA, 1989, *Mouse Oral Subchronic Toxicity of Pyrene.* Study conducted by Toxicity Research Laboratories, Muskegon, MI for the Office of Solid Waste, Washington DC.
QCE: 75 mg/kg/day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Relatively small group sizes, variability not addressed
Q_1	0.5	0.5	0.5	Although endpoint could occur in ROC, the ecological relevance is questionable since kidney lesions were mild.
Q_2	1	1	1	Chronic study (13 weeks)
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	No reproductive endpoints examined
Total AF	2	4	6	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	75	75	75	QCE = quantified critical endpoint
TRV	38	19	13	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	38	Test organism is in the same order and trophic level as the functional group members	none
2	19	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	13	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Selenium (Sodium selenite)** CAS 7782-49-2

Test Organisms: Chicken (Omnivore, Order-Galliformes)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference Ort, J.F. and J.D. Latshaw, 1978, "The toxic level of sodium selenite in the diet of laying chickens," Journal of Nutrition, 108:1114-1120.
EPA, 1993, Ch. 9. Selenium Effects at Kesterson Reservoir, A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective, EPA/630/R-92/005.
Eisler, R. 1985, Selenium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, U.S. Fish and Wildlife Service, Biological Report, 85(1.5).
QCE: 0.198 mg/kg-day (3mg/kg)*(0.132kg/hen-day**)/2kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Adequate numbers tested (100 female birds) and results are consistent with other studies in chickens and quail
Q_1	1	1	1	Endpoint ecologically relevant: egg production, egg weight and fertility, hatchability
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Older study but good design, however only females were tested
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.198	0.198	0.198	QCE = quantified critical endpoint
TRV	0.099	0.050	0.033	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.099	Test organism is in the same order and trophic level as the functional group members	none
2	0.050	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	0.033	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

**Ingestion rate specified in table 2 page 1116 of article

COPC: **Selenium (Sodium selenite)** CAS 7782-49-2

Test Organisms: Mallard (Herbivore, Order-Anseriformes)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Heinz, G.H. et al. 1987, "Reproduction in mallards fed selenium," Environmental Toxicology and Chemistry, 6:423-433.
Eisler, R. 1985, Selenium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, U.S. Fish and Wildlife Service, Biological Report, 85(1.5).
EPA. 1993, Ch. 9. Selenium Effects at Kesterson Reservoir, A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective, EPA/630/R-92/005.
QCE: 0.5 mg/kg-day (5 mg/kg * 0.1 kg feed)/ 1 kg bird

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	10 pairs for five doses tested, study results consistent with other studies in chickens and quail, repro/devel. toxicity analysis only.
Q_1	1	1	1	Ecologically relevant endpoint (egg hatchability)
Q_2	1	1	1	Chronic study (2-4 mos.)
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Reproductive study only with different forms of selenium
Total AF	2	4	6	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	0.5	0.5	0.5	QCE = quantified critical endpoint
TRV	0.25	0.13	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.25	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	0.13	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	0.08	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Rosenfeld, I. and O.A. Beath. 1954. Effect of selenium on reproduction in rats. Proc. Soc. Exp. Biol. Med. 87:295-297.

QCE: 0.075 mg/kg-day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Chronic toxicity studies with adequate numbers of animals
Q_1	1	1	1	Ecologically relevant endpoint (reproduction, number of young reared)
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Older study, but analyzed 5 breeding cycles and 2 generations. A more recent study by Nobunaga et al. (1979) reports a NOAEL of 390 ug/kg/day selenite for mice reproductive success.
Total AF	1	2	3	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	0.075	0.075	0.075	QCE = quantified critical endpoint
TRV	0.075	0.038	0.025	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.075	Test organism is in the same order and trophic level as the functional group members	none
2	0.038	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.025	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Mouse (Omnivore, Order-Rodentia)
Exposure Medium: Oral in water
Test Endpoint: FEL
Reference: Schroeder and Mitchner 1971. Toxic effects of trace elements on the reproduction of mice and rats. *Arch. Environ. Health.* 23: 102-106.
QCE: 0.76 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Adequate numbers of females (104) tested, no males or juveniles tested.
Q_1	1	1	1	Ecologically relevant endpoint (reproduction, number of young reared)
Q_2	1	1	1	Chronic study (3 generations)
Q_3	3	3	3	FEL endpoint (only one dose examined)
U	2	2	2	Good design, only reproductive endpoints (fetus) examined.
M	0.5	0.5	0.5	Placed in drinking water.
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.76	0.76	0.76	QCE = quantified critical endpoint
TRV	0.13	0.06	0.04	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.13	Test organism is in the same order and trophic level as the functional group members	none
2	0.06	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.04	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

*ingestion rate and BW specified in article

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Sheep (Herbivore, Order-Artiodactyla)
Exposure Medium: Diet
Test Endpoint: FEL
Reference: Eisler, R. 1985, Selenium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, U.S. Fish and Wildlife Service, Biological Report, 85(1.5).
QCE: 3.2 mg/kg-day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Secondary source
Q_1	1	1	1	Ecologically relevant endpoint (mortality)
Q_2	3	3	3	Acute study
Q_3	3	3	3	FEL - Lethal endpoint
U	3	3	3	Secondary source
Total AF	81	162	243	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	3.2	3.2	3.2	QCE = quantified critical endpoint
TRV	0.04	0.02	0.01	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.04	Test organism is in the same order and trophic level as the functional group members	none
2	0.02	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	0.01	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Black-crowned Night Heron
Exposure Medium: Diet
Test Endpoint: LOAEL
Reference: Smith, G.J., et al., 1988, "Reproduction in Black-Crowned Night-Herons Fed Selenium." *Lake and Reservoir Mgmt.* 4(2):175-180.

QCE: 2.5 mg/kg-day — 10 mg/kg in diet converted to dose by multiplying by 0.212 kg/day ingestion rate and dividing by 0.85 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Adequate numbers of males and females tested (12 pairs), study results consistent with other studies in chickens and quails.
Q_1	1	1	1	Hatching success, organ weights, blood measures, eggshell thickness, however 3-day-old hatchlings had shorter femurs and radius ulna legs and other hematological effects.
Q_2	1	1	1	Chronic study
Q_3	2	2	2	LOAEL
U	2	2	2	No NOAEL established. Reproductive endpoints examined.
Total AF	8	16	24	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	2.5	2.5	2.5	QCE = quantified critical endpoint
TRV	0.31	0.16	0.10	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.31	Test organism is in the same order and trophic level as the functional group members	none
2	0.16	Test organism is in a different order and same trophic level from the functional group members	AV310, AV322, AV322A, AV333, AV342
3	0.10	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222AAV232, AV233, AV241, AV242, AV432, AV432A, AV442

COPC: **Silver** CAS 7440-22-4

Test Organisms: Mouse (Omnivore, Order-Rodentia)
Exposure Medium: Drinking Water
Test Endpoint: FEL
Reference: Rungby and Danscher, 1984, "Hypoactivity in silver exposed mice," Acta Pharmacol and Toxicol, 55(5):398-401.
QCE: 3.0 mg/kg-day (0.09 mg/ 0.03 kg)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Females only for the long-term study
Q_1	0.1	0.1	0.1	Not clearly relevant endpoint
Q_2	2	2	2	Subchronic duration
Q_3	3	3	3	FEL
U	2	2	2	Only one dose, no NOAEL identified.
M	0.5	0.5	0.5	Placed in drinking water
Total AF	1.2	2.4	3.6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	3	3	3	QCE = quantified critical endpoint
TRV	2.5	1.3	0.8	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	2.5	Test organism is in the same order and trophic level as the functional group members	none
2	1.3	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.8	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Sulfate** CAS 14808-79-8

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Oral in diet
Test Endpoint: LD_{90}
Reference: Venugopal, B. and T.D. Luckey, 1978. *The Toxicity of Metals in Mammals*, New York, Plenum Press.
QCE: 1,292 mg/kg-day (from potassium sulfate)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Secondary source so information on number and sexes of animals tested unknown.
Q_1	1	1	1	Ecologically relevant endpoint (lethality)
Q_2	3	3	3	Duration of exposure unknown
Q_3	3	3	3	FEL – lethality
U	3	3	3	Limited information and reproductive endpoints and sensitive life stages examined. No NOAEL established.
Total AF	81	162	243	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	1292	1292	1292	QCE = quantified critical endpoint
TRV	15.95	7.98	5.32	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	15.95	Test organism is in the same order and trophic level as the functional group members	none
2	7.98	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	5.32	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Sulfate**

Test Organisms: Turkeys (Omnivore, Order-Galliformes)
Exposure Medium: Oral in diet
Test Endpoint: NOAEL
Reference: Cakir, A., T.W. Sullivan, and F.B. Mather, 1978. Alleviation of fluorine toxicity in starting turkeys and chicks with aluminum. Poultry Science 57:498, as cited in National Academy of Sciences, 1980. Mineral Tolerance of Domestic Animals. Washington, DC.
QCE: 207.4 mg/kg-day (from aluminum sulfate)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	1-day old turkeys tested. Secondary source so information on number of animals tested not available.
Q_1	1	1	1	Endpoint ecologically relevant
Q_2	2	2	2	Subchronic study (28 days)
Q_3	1	1	1	NOAEL
U	2	2	2	Limited information. Sensitive life stage examined. NOAEL established. Test organisms exposed to $Al_2(SO_4)\cdot 18H_2O$
Total AF	8	16	24	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	207.4	207.4	207.4	QCE = quantified critical endpoint
TRV	25.93	12.96	8.64	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	25.93	Test organism is in the same order and trophic level as the functional group members	none
2	12.96	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	8.64	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342